Appendix K
Sample Specifications to Furnish and to Install Wire Rope

K-1. Furnish Wire Rope

SECTION [_____]
FURNISH WIRE ROPE FOR GATE-OPERATING DEVICES

(Note to Designer: This sample specification is provided to aid designers develop a contract spec to purchase wire rope. It needs to be formatted and updated as necessary. It is based on the assumption that the Government is purchasing wire rope for a gate-operating device, and that it will be either placed in storage, or installed by Government forces or by a separate contract. The following sample specification has been developed for installing Government furnished wire rope by a contractor. If a contractor is responsible to both supply and install then use UFGS 12290A. It is advised that the designer read Engineer Manual EM 1110-2-3200 before using these specifications.)

PART 1 GENERAL

1.1 REFERENCES

The publications below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-W-410	(Rev E) Wire Rope and Strand
FS RR-S-550	(Rev D; AM 1) Sockets, Wire Rope

WIRE ROPE TECHNICAL BOARD (WRTB)

WRTB	(1993) Wire Rope Users Manual

ASTM INTERNATIONAL (ASTM)

ASTM A 148/148M	(2003) Steel Castings, High Strength for Structural Purposes
ASTM A 123/123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron & Steel Products
ASTM A 351/351M	(2003) Standard Specifications for Castings, Austenitic, Austenitic- Ferritic (Duplex) for Pressure Containing Parts

1.2 SUMMARY

The Contractor shall furnish and deliver wire rope to the [_____] Project. The [_____] Project is located on the [_____] River approximately [_____] miles _____ of the city of [_____]. The wire rope is for installation in the operating equipment for [spillway] [tainter] [_____] gates. The wire rope shall be manufactured, prepared for delivery, and delivered in accordance with the requirements of this section. Installation will be by [a separate contract.] [project forces.]

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise indicated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Work Plan; G

Work plan shall include:

Schedule for manufacture of products
Schedule for delivery

SD-02 Drawings

Fabrication drawings for end terminations; G

SD-03 Product Data

Lubrication; G
Brand/specifications for factory lubricant

Pre-Stretching; G
Pre-stretching procedure

Method of attaching end terminations; G

Wire Rope Manufacturer's Qualifications; G
Wire rope manufacturer's qualification statement

Test Reports; G
Rope tension test report

Attaching and Proof Loading Terminations; G
Proof load of terminations test report and measured rope lengths

Wire Strength and Ductility; G
Wire strength and ductility test results

Pre-forming; G
Verification of pre-forming test results

Stress Relief; G
Stress relief verification test results

Zinc Coating; G
Zinc coating test results

End Terminations; G
Materials properties test for casting end terminations

SD-07 Certificates

Wire Material; G
Wire material certification

Tension Testing Device; G
Certification of rope tension testing device

1.4 MANUFACTURER'S QUALIFICATIONS

The wire rope shall be the standard product of a manufacturer regularly engaged in the manufacture of wire rope, and shall essentially duplicate products having been in satisfactory use for at least 3 years prior to bid opening.

1.5 SITE VISITS/INSPECTIONS

The Contractor shall be prepared to accommodate up to two representatives of the COR to witness the various manufacturing processes for the wire rope. At a minimum, a site visit will be made to witness the tension test, and the wire rope will be inspected upon delivery.

PART 2 PRODUCTS

2.1 WIRE ROPE AND SOCKET

2.1.1 Quantity

The Contractor shall furnish [____ wire ropes with end terminations (sockets) at both ends. Each wire rope shall be of the length indicated on Drawing No. ____, and within the tolerance also indicated on that drawing.] [_____ feet of wire rope. The wire rope shall be wound on reels in lengths such that _____ sections, each with a length of _____ feet will be available for use, as splicing will not be allowed.]

2.1.2 Type of Wire Rope

(Note to Designer: EM 1110-2-3200 provides information that will help the designer select the strand configuration. In many Corps applications existing regular lay wire rope would best be replaced by lang lay wire rope. This is discussed in more detail in EM 1110-2-3200. Also, stainless steel wire rope tends to abrade itself when wrapped on disk-layered drums. Some manufacturers are questioning the wisdom of making regular lay stainless steel wire rope with flattened strands, as the cold working tends to be excessive and weaken the rope. Stress relieving to alleviate the cold working can be difficult and inconsistent with stainless steels.)

The wire rope shall be of the following type:

a. Strand configuration: [6x19 Seale] [7x19 Seale] [6x26 Warrington Seale Swaged] [_____].

b. Lay: [right, regular] [left, regular] [right, lang] [left, lang]

c. Diameter: [_____] inch, with a tolerance of – 0 and plus 5 percent

d. Finish: [galvanized] [not galvanized]

e. Material: [extra improved plow steel] [302 stainless] [304 stainless] [_____]

f. Core type: Independent wire rope core

2.1.3 Pre-stretching

(Note to Designer: Pre-stretching is highly recommended for installations with multi-rope drums, because initial stretch in the ropes tends to be uneven. Pre-stretching will likely result a more equal tension between the ropes. It is also recommended for other wire rope so that final length after use will be closer to length at the time of installation.)

The manufacturer shall pre-stretch the [wire rope.] [wire ropes before attaching their end terminations.] This shall be done by subjecting them to three cycles at 40 percent of its nominal strength. The 40 percent loads shall be held for 5 minutes with 5 percent loads for 5 minutes between cycles. The manufacturer may propose a method of dynamic pre-stretching.

2.1.4 Wire Strength and Ductility

The manufacturer shall perform testing in accordance with FS RR-W-410 to verify wire strength and ductility.

2.1.5 Pre-forming

The wire rope shall be pre-formed, and manufacturer shall perform testing in accordance with Federal Specification RR-W-410D to verify pre- forming.

2.1.6 Stress Relief

The wire rope shall be stress relieved, and the manufacturer shall perform testing in accordance with Federal Specification RR-W-410D to verify stress relief.

2.1.7 Weld Distribution

Wire joints in any strand shall not be closer than 18 inches in any strand.

2.1.8 Galvanizing

(Note to Designer. Wire rope weaved from galvanized wires will have much better resistance to corrosion than un-galvanized wire rope weaved from bare carbon steel. It will also have better resistance to corrosion than wire rope weaved from drawn galvanized wire. However, it will also have a significantly lower strength. If full strength is required, then use wire rope weaved from plain carbon steel or from drawn galvanized wire depending on how important corrosion resistance is. If full strength is not required, but high corrosion resistance is required, use wire ropes weaved from galvanized wire and perform the zinc coat test to verify the zinc thickness. See RR-W-410 for information on the rate of zinc coating. Of course stainless steel wire rope would not be galvanized, and this entire paragraph would be deleted.)

[The wire rope shall be weaved from drawn galvanized wire. That is, the wires shall be galvanized prior to their last drawing operation. The wire rope shall have the same accepted industry standards for nominal strength as it would, had it not been galvanized.] [The wire ropes shall be weaved from galvanized wire. Zinc shall be applied at a rate of _____ ounces per square foot of wire surface. The manufacturer shall perform testing in accordance with FS RR-W-410 to verify the zinc coating has been applied at the required rate.]

2.1.9 Lubrication

(Note to Designer. If specifying stainless steel wire rope, which will rarely be used, it may be best to specify that it not be lubricated. As explained in EM1110-2-3200, in some cases the presence of a heavy lubricant will increase corrosion on stainless steel wire ropes.)

[The manufacturer shall lubricate the wire ropes at the manufacturing facility. The lubricant shall be applied with equipment capable of forcing the lubricant between the rope wires, including the center strand.] [The wire rope shall not be lubricated.]

2.1.10 Pitch Length

Strand pitch length shall not be less than 4-1/2 times the nominal rope diameter.

2.1.11 Core Strand Wires

The number of wires in the core strand shall be equal to or greater than the number of wires in the other strands. The wires shall be of the same material as the wires in the other strands, or of a material with a lower tensile strength.

2.1.12 End Terminations

(Note to Designer: EM 1110-2-3200 discusses materials and coatings, and attachment methods for sockets. If for multi-rope drums it is advantageous to have the sockets attached at the wire rope manufacturer's facility. For very long wire ropes in other applications this may be impractical. However, even if the sockets are to be attached in the field, it may still be advantageous to have the sockets supplied by the contractor supplying the wire rope. Note that the wire rope industry usually recommends replacing sockets when replacing wire rope.)

The wire rope end terminations (sockets) shall be fabricated as indicated on Drawing No. _____. They shall be cast from [steel conforming to ASTM A 148, Grade 105-85] [stainless steel conforming to ASTM A 351 CF8M] [_____].

2.1.13 Tension Testing

A tension test shall be performed to verify the wire rope meets the accepted industry standards for nominal strength. Two rope samples shall be tested to failure to be sure the expected performance level has been met. The test shall be performed using suitable equipment and by qualified personnel, both furnished by the Contractor. The rope samples shall cut to no less than 3 feet of length. The test will not be considered valid if the failure occurs less than 2 inches from either socket or holding mechanism. Relative speed between the machine heads shall not exceed 1 inch per minute.

2.1.14 Attaching and Proof Loading Terminations

(Note to Designer: EM 1110-2-3200 suggests that pre-stretching the wire rope and proof loading the terminations might be accomplished simultaneously. However, for multi-rope drums the wire rope would need to be pre-stretched first to be sure they are closer to their final correct length before attaching the terminations. If the sockets must be attached in the field delete this paragraph.)

The manufacturer shall attach the end terminations after pre-stretching the wire rope. The attachment method shall be as indicated on Drawing No. [_____]. After their attachment, the wire ropes shall be proof loaded at 40 percent of nominal strength of the rope. Length of the wire ropes shall be measured to the nearest 0.01 inch at a load of [_____].

PART 3 EXECUTION

3.1 PACKING AND DELIVERY

The wire ropes shall be wound on spools in the same direction as they were bent during manufacturing. The spools shall be covered for protection from rain, snow, and road splatter during shipping.

3.2 UNLOADING AND INSPECTION

(Note to Designer. Consider altering or deleting this paragraph to reduce cost, especially if the wire rope will be installed very soon after delivery, or if supply and installation is by a single contractor.)

Upon delivery, the wire [ropes] [ropes and sockets] shall be unloaded by the Contractor in a location chosen by the representative of the COR, where they will be inspected for dings, kinks or other damage in the presence of the COR's representative. The wire ropes shall be reeled from spool to spool in order to allow complete inspection over their entire length. The Contractor shall perform the unreeling/reeling operation, and furnish extra spools and any other equipment required. The final spools on which the wire ropes are wrapped shall become Government property. Upon completion of the inspection, the representative of the Contractor's representative shall present the COR's representative with a written report of the results.

- End of Section -

K-2. Install Wire Rope

SECTION [_____]
INSTALL WIRE ROPE FOR GATE-OPERATING DEVICES

(Note to Designer: This sample specification is provided to aid designers develop a contract spec to install wire rope. It needs to be formatted and updated as necessary. If a contractor is responsible to both supply and install then use UFGS 12290A. It is assumed that installation will be at an existing facility. It is advised that the designer read Engineer Manual EM 1110-2-3200 before using these specifications.)

PART 1 GENERAL

1.1 GENERAL INFORMATION

The Contractor shall provide all tools, equipment, personnel, and expertise to remove the existing wire rope from the operating devices for the [one] [two] [____] [spillway] [tainter] [_____] gates at the [_____] Project, and install new Government furnished wire rope. The [_____] Project is located on the [_____] River approximately [_____] miles [north] [east] [south] [west] [_____] of the city of [_____].

1.2 REFERENCES

The publications below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 Safety and Health Requirements Manual

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-W-410 (Rev E) Wire Rope and Strand
FS RR-S-550 (Rev D; Am 1) Sockets, Wire Rope

WIRE ROPE TECHNICAL BOARD (WRTB)

WRTB (1993) Wire Rope Users Manual

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise indicated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Work Plan; G

Work plan shall include:
Schedule for installation
Removal plan for old wire rope
Installation plan for new wire rope
Plan for tensioning wire rope
Safety plan

SD-02 Drawings

Fabrication drawings for end terminations; G

SD-03 Product Data

Lubrication; G
Brand/specifications for factory lubricant

Method of attaching end terminations; G

Attaching and Proof Loading Terminations; G
Proof load of terminations test report and measured rope lengths

SD-07 Certificates

Tension Testing Device; G
Certification of rope tension testing device

1.4 CONTRACTOR QUALIFICATIONS

The Contractor shall, as a minimum, have a supervisor at the site experienced in the installation of wire rope. The supervisor shall have performed work similar to that required in this contract on at least three occasions. The supervisor's experience shall be submitted and approved before work at the site may begin.

1.5 SITE VISIT

It is highly recommended that bidders visit the site before submitting bids. Drawings and verbal descriptions cannot fully describe the effort required to satisfactorily complete the contract work. A pre-bid site visit, between the dates of [____] and [____] can be arranged be contacting [_____] at telephone number [_____].

1.6 VERIFY DIMENSIONS

The Contractor shall become familiar with the details of the work, verify dimensions in the field, and immediately advise the Contracting Officer of any discrepancies before performing any work.

PART 2 PRODUCTS

2.1 WIRE ROPE

(Note to Designer. Choose the first sentence if the Government furnished wire rope has sockets attached, or the second if the Contractor will be required to attach the sockets (also Government furnished.)

[The Government will furnish _____wire ropes with end terminations (sockets) at both ends. The wire rope will be of the length and end terminations will be as indicated on

attached Drawing No. ____. The wire rope type will be as follows:] [The Government will furnish _____ feet of wire rope as follows:]

a. Strand configuration: [6x19 Seale] [7x19 Seale] [_____]

b. Lay: [right, regular] [left, regular] [right, lang] [left, lang]

c. Diameter: [_____] mm inch, with a tolerance of – 0 and plus 5 percent

d. Finish: [galvanized] [not galvanized]

e. Material: [extra improved plow steel] [302 stainless] [304 stainless] [_____]

f. Core type: independent wire rope core

g. Pre-formed

2.2 END TERMINATIONS

(Note to Designer. If the sockets are factory attached to the wire rope, delete this paragraph.)

The Government will furnish wire rope end terminations (sockets) to be installed by the contractor. They will be fabricated as indicated on Drawing No. [_____].

2.3 TOOLS, EQUIPMENT & EXPERTISE

The Contractor shall furnish all tools and equipment, and expertise needed to perform the specified work.

2.4 LUBRICANT

(Note to Designer. If stainless steel wire rope is used, delete this paragraph. As explained in EM1110-2-3200, in some cases the presence of a heavy lubricant will increase corrosion on stainless steel wire ropes.)

The Contractor shall furnish the lubricant needed to lubricate the wire rope after installation. The Contractor shall submit the proposed type lubricant in the work plan. The lubricant shall be compatible with the factory-applied lubricant on the government furnished wire rope.

PART 3 EXECUTION

3.1 WORK PLAN

The work required is complicated nature, requiring technical expertise and planning. The Contractor shall submit a work plan, which will indicate how the existing wire rope will be removed and how the new wire rope will be installed without damaging either existing equipment or the new wire rope. The work plan shall also include a schedule indicating how the work will be accomplished within the time limit of this contract. The work plan shall be submitted and approved before any work can be performed.

3.2 SAFETY PRECAUTIONS/SAFETY PLAN

The work area and conditions, and type of work required create considerable potential for accidents. The Contractor shall submit a safety plan indicating how accidents will be prevented. The safety plan should include details of how the wire rope will be handled and installed to minimize the risk to personnel. Work shall be in accordance with the U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1.

3.3 CLEAN DRUMS AND SHEAVES

The Contractor shall clean all drum and sheave grooves with a power wire brush, and inspect them for wear, abrasion, corrosion or other roughness and verify their dimensions are suitable for the new wire rope. The Contractor shall immediately advise the Contracting Officer of any problems.

3.4 WORK AND STORAGE AREAS

[The Contractor's work and storage areas are as indicated on Drawing No. _____]. [The work areas are as indicated on Drawing No. _____. A representative of the COR will assign the Contractor a storage area in the vicinity of the work area.]

3.5 DELIVERY AND INSPECTION OF GOVERNMENT PROPERTY

The Government furnished material, [wire rope and sockets] [wire rope] is currently stored at the [_____]. The Contractor shall transport these items to the work area/Contractor storage area. Before transporting them, the Contractor shall inspect these items in the presence of the COR's representative. In particular, the Contractor shall thoroughly inspect the wire rope for dings, kinks or other damage. Upon completion of the inspection, the representative of the Contractor's shall furnish the COR's representative with a written report of the results.

3.7 ATTACHING SOCKETS

The Contractor shall attach the end terminations to the wire rope in accordance with Drawing No. [_____] and the recommendations of RR-W-410D Wire Rope and Strand, and the Wire Rope Users Manual.

3.8 UN-REELING AND INSTALLING WIRE ROPE

The wire rope(s) shall be attached to drums, pulleys as shown on Drawing No. [_____]. Provide at least two dead wraps of the rope on the drum. The Contractor shall ensure that the wire rope is wound under adequate tension and that the each wind of the rope(s) is guided to its proper location. The wire rope shall be wound in the same direction it was bent during its manufacture. The Contractor shall insure that no twists or loops occur. The Contractor shall submit the proposed method of un-reeling and installing in the work plan.

3.9 FIELD TENSIONING MULTI-LINE HOISTS

The Contractor shall adjust the tension of the wire ropes to insure that they share load equally. The Contractor shall submit the proposed method field tensioning in the work plan. After break-in/testing they shall be tested to determine if they share load equally, and if not, they shall be re-tensioned.

3.10 LUBRICATION

(Note to Designer. If stainless steel wire rope is used delete this paragraph. As explained in EM 1110-2-3200, in some cases the presence of a heavy lubricant will increase corrosion on stainless steel wire ropes.)

The Contractor shall lubricate the wire ropes after they are installed. The Contractor shall submit the proposed method in the work plan.

3.11 BREAK-IN/TESTING

After installation is complete, the Contractor shall run the gate-operating device through [one] [two] [three] [four] [____] complete cycles, full open to full closed.

3.12 REMOVAL OF EXISTING (OLD) WIRE ROPE

After its removal, the old wire rope shall become the property of the Contractor. Contractor shall then remove the old wire rope from the project.

3.13 ORDERLY WORK AREA/SITE CLEANUP

The Contractor shall, as much as possible, maintain neat and orderly storage and work areas. The Contract will not be considered complete until all the Contractor’s tools, equipment and property have been removed from the site, and the Contractors storage and work areas have been properly cleaned up. All dirt, debris, litter etc. shall be removed from project and disposed of in a proper manner. Special care shall be taken to insure that no materials fall into or contaminate project waters.

- End of Section -